1 meter or less. Coast Guard beacons or private commercial satellites can provide differential GPS (DGPS). A DGPS receiver is often the most practical choice for creating mazes.

Survey grade receivers, which are single or dual frequency receivers, offer the highest accuracy and can determine a position to within a few centimeters. Some advanced agricultural receivers perform in this range as well. Survey grade receivers are ideal for laying out very fine details of mazes in small fields. But they are quite expensive and may not be cost effective for maze projects.

Mapping software or GIS software must be selected that will allow the user to download a map of the field and the maze design. The software should be able to run on a handheld PC or a laptop computer so it can be taken into the field. The software also should accept GPS data from a receiver connected to the computer. Real-time GPS data are needed to guide the designer to the critical points on the maze. "Real-time" means that the position determined by the receiver must be the actual position of the receiver at that moment. Long-term averaging of data to get an accurate position is not practical in creating a maze.

Creating the Maze

Make a Map of the Field's Boundaries

Once a target field is selected, a map of its boundaries must be obtained. Aerial images of the field can be used, or a map of the field boundaries can be recorded by using the GPS receiver and mapping software.

The preferred approach is to create a boundary map of the field with the GPS receiver and the mapping software. Turn on the GPS receiver, and set the software to record a boundary. Walk or drive around the perimeter of the field while logging boundary data from the GPS receiver. The mapping software can be configured to automatically log data or to log data on command from the operator. When you have traveled completely around the field, the software will have recorded the boundary and displayed it on the computer screen. Save the boundary data on the computer for later use.

If you are using an aerial image of the field, the image must be correctly geo-referenced in the mapping software. This means that precise latitude and longitude coordinates must be assigned to several features on the map. This process is often called "registering the map." Up to three points on the map must be identified and the coordinates of these points determined. Instructions for this procedure should be provided in the mapping software. Once a field image is acquired, you can use it to draw a boundary of the field with the drawing tools built into most mapping software.

Regardless of the approach taken, the objective is to create a boundary map of the field (Figure 1). Once established, the boundary map can be used as a frame for the maze design.

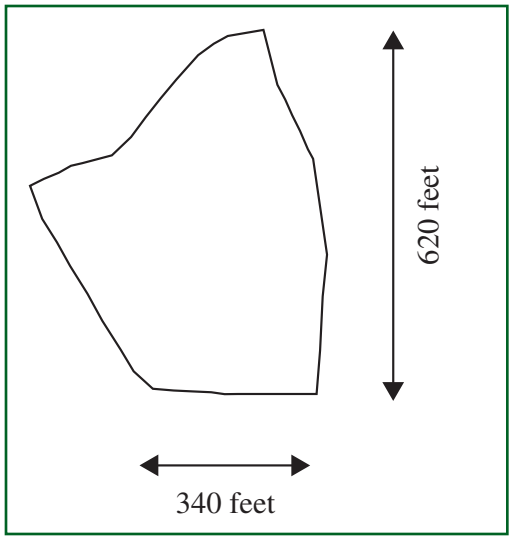

Figure 1. A field boundary map.

Design the Maze

The maze design should be selected so that it fits easily within the borders of the field. This can be done in one of two ways. One approach is to draw the design directly in the digital map file using the drawing tools provided by the mapping software. Displaying the field boundary file in the background will ensure the design is properly geo-referenced, which is the advantage of using this approach. But, drawing a maze design on the screen may require a good bit of practice, particularly with more complex shapes. Use of a drawing tablet or a digitizing tablet may aid the process.

Another method is to print a copy of the boundary map. Make certain the boundaries of the field are clearly visible on the printout. If the map has not been geo-referenced, determine the coordinates of at least three easily located points on the field boundary. Record these coordinates on the map to use in geo-referencing later. These points should be spread out